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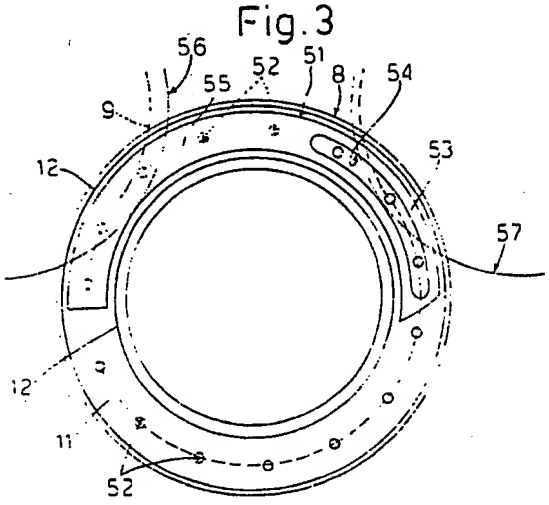
(54) A capsule filling machine

(57) A machine for filling powdered pharmaceutical products into capsule bases 2 comprises:
a rotating annular powder receptacle 8;
apertures 52 formed in the bottom wall 11 of the receptacle and of smaller diameter than that of the capsule base;
a fixed body 51 within the receptacle, close to the bottom wall and adapted to block off the apertures during part of their path of movement whilst leaving the apertures in communication with the powder during their remaining path of movement;
transport belt means 9 for transporting the capsule bases along said remaining path beneath the receptacle bottom wall;
and axially reciprocable pins 42 each coaxial with a respective aperture and mounted for rotation with the receptacle about the same axis of rotation the pins being operable to press the capsule bodies against the underside of the receptacle bottom wall during movement of the apertures 52 along said remaining path of movement.

Fig.3



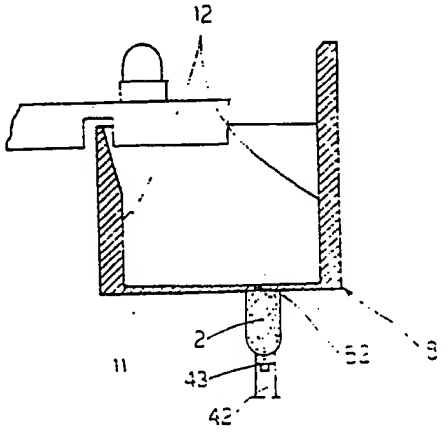


Fig.2

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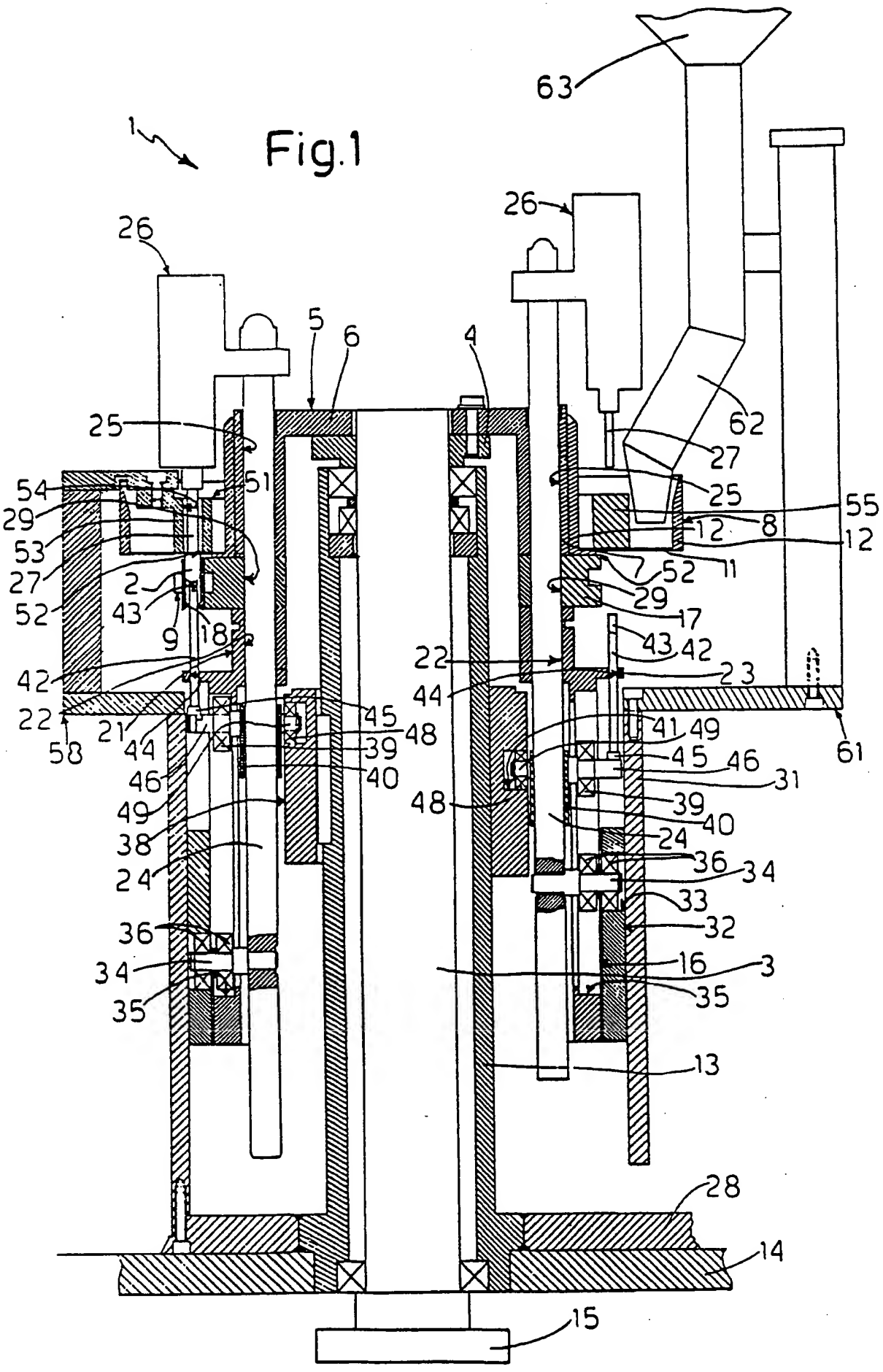
Fig.1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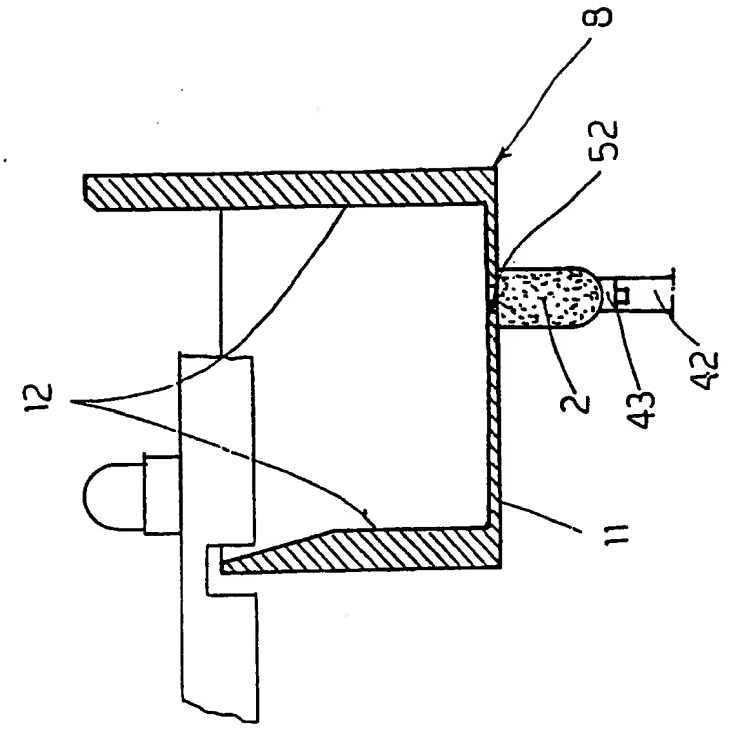

Fig.2

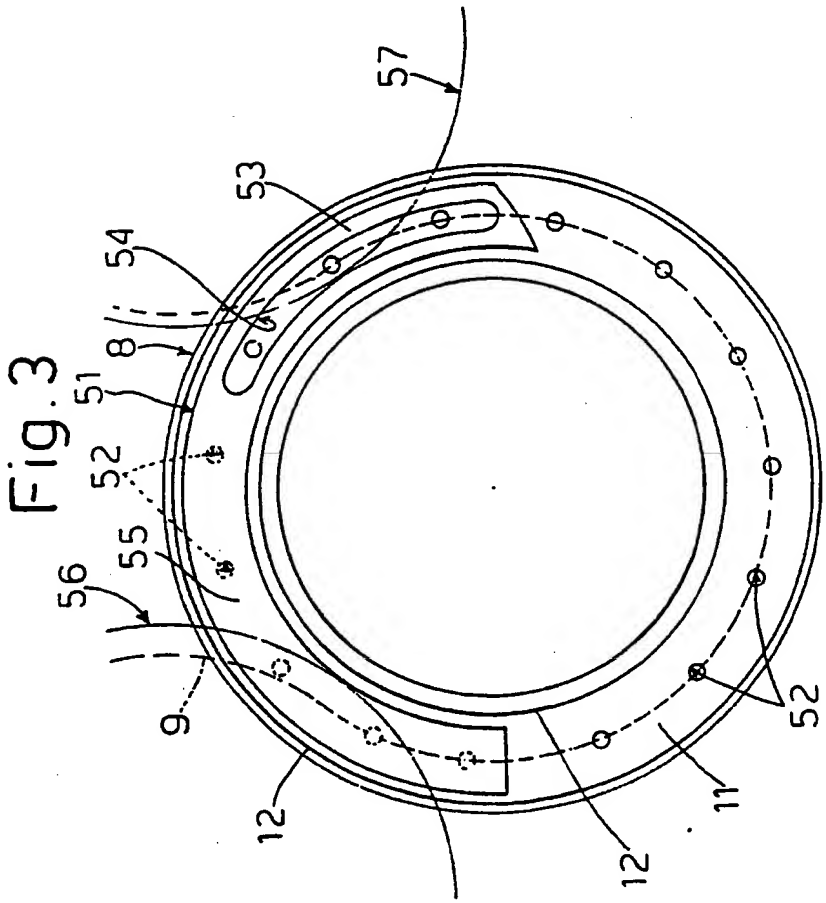

Fig.3

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A MACHINE FOR METERING POWDERED PHARMACEUTICAL PRODUCTS INTO A CONTAINER

The present invention relates to a machine for metering a predetermined quantity of powdered pharmaceutical products into a container, preferably a capsule base.

Machines of the above indicated type currently in production comprise a rotating receptacle supplied with the said powdered pharmaceutical products. The receptacle has on its bottom wall a plurality of apertures beneath which the capsule bases are conveyed. In use a semi-annular body is housed within the receptacle, which is known to those in the art as a scraper, and the function of which is that of covering some of the said apertures at each revolution in such a way that the powder cannot escape from the receptacle through these. The apertures not covered by the scraper have an associated base into which the powder falls. Machines of the more current type also include a rotating drum element which carries a plurality of vertical pins, equal in number to the said holes, which are slidable axially in a reciprocating manner. These pins are used to compact the powder falling into the base by pressing one or more times so that a greater quantity of powder can be deposited into them.

Machines of the type described have a serious disadvantage due to the fact that the powder falling through the apertures can also fall onto the outside of the base. This causes a waste which at times can be very high, dusting of the outside of the base, and an unwanted introduction of the powder into the environment. This can be dangerous both for the workers and for those parts of the machine itself, particularly the movable parts, since the powder can significantly increase the friction and thus the force resisting their movement.

The object of the present invention is that of providing a machine for metering powdered pharmaceutical products into a container, which will be free from the above-mentioned disadvantages.

According to the present invention there is provided a machine for metering a predetermined quantity of powdered pharmaceutical products into a container, preferably a capsule base, characterised by the fact that it comprises:
a receptacle rotating about a vertical axis and into which the said powder is supplied;
at least one first aperture passing through a base wall of the said receptacle and of diameter less than that of the said container;
a fixed body installed within the said receptacle with its lower face close to the upper face of the said base wall,

and adapted to define a first path for the said first aperture in which this faces a lower face of the said fixed body and therefore is not in contact with the said powder, and a second path in which the said aperture is in direct communication with the said powder;

transport means for transporting the said container beneath the said receptacle and along the said second path defined by the said first aperture; and

a lower vertical pin coaxial with the said first aperture, carried into rotation by a first rotating body rotatable about the said axis and in synchronism with the said receptacle, and adapted to translate, by the action of second means, alternately along its longitudinal axis between a first position, assumed for the whole of the said second path, in which it presses the said container against the lower face of the said base wall coaxial with the said first aperture, and a second position, assumed for at least a section of the said first path, in which it is withdrawn entirely from the seat formed in the said transport means to house the said container.

For a better understanding of the present invention a preferred embodiment will now be described, purely by way of non-limitative example, with reference to the attached drawings, in which:

Figure 1 is a sectional side view of a machine formed

according to the principles of the present invention;

Figure 2 is an enlarged view of a detail of the machine of Figure 1; and

Figure 3 is a schematic plan view of the machine of Figure 1.

As illustrated in Figure 1, a machine for metering powdered pharmaceutical products into a capsule base 2 is generally indicated with the reference numeral 1. The machine 1 comprises a vertical rotatable shaft 3 at the upper end of which is formed an annular flange 4 which coaxially supports an annular body 5 of inverted cup-shape. The body 5 is defined by a base wall 6 fixed by means of screws to the flange 4 and by a cylindrical side wall 7 which extends downwards. An annular receptacle 8 defined by a base wall 11 and by two side walls 12 having a cylindrical form is fixed to the body 5 by screws which fix the inner wall 12 to the wall 7. The machine 1 further includes a cylindrical fixed hollow vertical column 13 which coaxially houses the shaft 3 within its interior. This column 13 is fixed at its lower end to a fixed support bed 14 beneath which extends the lower end of the shaft 3 which carries a toothed wheel 15 meshing in a known way with a toothed wheel of a driving device not shown for simplicity.

Coaxially of the fixed column 13 and externally of this is

fitted a rotating annular column 16. Coaxially between the wall 7 and the rotating column 16 is fitted a ring 17 the cylindrical lateral face of which is shaped in such a way as to form a meshing engagement between itself and a belt 9 which carries a plurality of bushes 18 within which are housed respective capsule bases 2. The machine 1 forms part of an installation which, includes a first machine for delivering the capsule, removal of the cover of the capsule from the base 2, and deposition of the bases 2 in corresponding bushes 18. The belt 9 (as partially and schematically illustrated in Figure 2) then passes around the whole of the installation traversing one or more metering machines until rejoining with its associated cover. All the machines include a flange similar to the ring 17 which forms a meshing engagement with the belt 9 carrying the bushes 18. Finally all of the rotating shafts of the machines of the installation are driven to rotate by the same driving device by means of pulleys or known transmission mechanisms.

With reference to Figure 1, at the upper end of the column 6 there is defined, integrally therewith, an annular drum-shape body 21 in which uniformly distributed vertical apertures 22 are formed, and on which is defined, again integrally, an annular flange 23. The body 21 has a mean circumference of diameter less than that of the corresponding mean circumference of the column 16, whilst

the flange 23 extends from the outer lateral wall of the column 16. The machine 1 includes a plurality of vertical bars 24 each of which traverses a respective vertical aperture 25 formed in the wall 7 of the body 5 and, a respective aperture 29 formed in the ring 17. The bars 24 are axially slidable and extend upwards beyond the level of the receptacle 8. The upper end of each bar 24 supports a small block 26 from which a pin 27 extends downwardly into the receptacle 8.

At the lower end of the fixed column 13 and above the level of the bed 14 there is fixed coaxially to the column 13, by welding, an annular plate 28 which supports a fixed annular body 31 which extends upwardly coaxially of the shaft 3 and the columns 13 and 16 and outside these. On its inner surface the body 31 supports an annular sleeve 32 along the inner surface of which is formed a track 33. Each bar 24 in its intermediate zone carries a fixed horizontal pin 34' which, through a slot 35 formed in the column 16, extends radially out of this latter. Each pin 34 supports two bearings 36 one of which is within the slot 35 and the other within the track 33.

An annular sleeve 38 is fixed, by means of a key, to the fixed column 13 within a space defined by the column 16. On the outer lateral surface of the sleeve 38 there is formed a track 41. Coaxially with each pin 27 the machine

1 is provided with a second vertical pin 42 which is axially translatable and located beneath the level of the base wall 11 of the receptacle 8. The upper end of each pin 42 is provided with a head 43 made of resiliently deformable material such as, for example, rubber or equivalent plastics material. In the flange 23 there is formed a plurality of vertical apertures 44 along which the pins 42 are able to slide axially. Beneath the flange 23 the lower end of each pin 42 is carried by a respective block 45 from which extend respective pins 46 projecting radially towards the central axis of the machine 1. Each pin 46 traverses the slot 35 in correspondence with which it carries a bearing 39, and is fixed radially to a vertical bush 40 within which a respective bar 24 is free to slide. From this bush 40 extends a second pin 49 coaxial with the pin 46 which, with the interposition of a bearing 48, is located in the track 41.

With reference to Figures 1 and 3, within the receptacle 8 there is a fixed body 51 of semi-circular outline and which is known to those in the art as a "scraper". A plurality of apertures 52, equal in number to that of the pins 42, are formed in the wall 11. These apertures 52 are uniformly distributed around the intermediate circumference of the wall 11 and above each aperture 52 there is an associated pin 27 whilst below each aperture there is an associated pin 42. The longitudinal axis of

the body 51 describes an arc of predetermined length along the circumference of the circle described by the centres of the apertures 52. The lower face of the body 51 is very close to the upper face of this wall 11 in such a way that the body 51 defines the lateral deviation of the powder contained in the receptacle 8 during rotation of this and therefore defines a first path in which the apertures 52 are occluded by the body 51 itself and a second path in which the apertures 52 are in direct communication with the powder. The body 51 has a first section 53 in which there is formed a vertical through slot 54 and a second solid such section 55. Naturally the slot 54 extends along the same arc as that described by the longitudinal axis of the body 51 and is not involved with the powder which remains to the sides of the body 51. The diameter of the apertures 52 is less than the diameter of the capsule bases 2. The belt 9 which carries the bushes 18 from machine 56, partially and schematically illustrated in Figure 3, enters into engagement with the flange 17 of the machine 1 at an intermediate zone of the solid section 55, describes an arc along the said circumference defined by the apertures 52, and leaves the machine 1, meshing with a subsequent machine 57 (also schematically and partially illustrated in Figure 3) at an intermediate zone of the section 53. Now the bush 18 and therefore the capsule base which it carries is coaxial with the corresponding aperture 52 and the corresponding

pins 27 and 42.

The body 31 supports the body 51 at its upper end by means of a series of brackets 58 and by means of a second series of brackets 61 it supports a duct 62 for supplying powder to the receptacle 8. The duct 62 extends from a hopper 63 only the lower part of which is illustrated in Figure 1, and extends into the receptacle 8 preferably between the solid section 55 and the outermost wall 12.

In use rotation of the shaft 3 causes rotation at the same speed of the body 5 and therefore of the receptacle 8 and the column 16 and therefore also of the pins 27 and 42. The tracks 33 and 41 are shaped such as to control reciprocating translation of the pins 27 and 42. In correspondence with the solid section 55, after the engagement between the belt 9 and the ring 17, the pins 42 enter from below into respective bushes 18 and press the capsule base 2 against lower face of the wall 11. Along the path not covered by the body 51 the capsule base 2 remains always pressed against the wall 11 so that the powder enters the capsule base 2 through the aperture 52 without falling towards the underlying parts of the machine 1. Along the path not covered by the body 51 the pin 27 is displaced downwardly one or more times until reaching the interior of the capsule base 2 to press the powder deposited in this one or more times. The more

pressing operations are performed the greater the quantity of powder which the capsule base 2 can accept. In correspondence with the initial part of the section 53 the pin 27 is translated upwardly beyond the upper level of the body 51 and as soon as this starts the slot 54 is translated downwardly for the last pressing of the powder in the capsule base 2 as illustrated in the left of Figure 1. Before the belt 9 leaves the machine 1 the pin 27 is translated upwardly beyond the upper level of the body 51 and the pin 42 is translated downwardly until it entirely leaves the bush 18 so as to permit the belt 9 to leave the machine 1 without any obstacle. For the whole of the solid section 55 the pin 27 is maintained at a higher level than that of this section 55 whilst the pin 42 is subsequently translated upwardly to the point in which engagement between the belt 9 and the ring 17 is achieved, naturally after commencement of the path not covered by the body 51.

From what has been illustrated the advantages achieved with the embodiment of the invention are evident.

In particular, with respect to current machines, the machine 1 is provided with pins 42 which enter into respective bushes 18 and press the corresponding capsule base 2 against the lower face of the wall 11. Since the diameter of the aperture 52 is less than the diameter of the

capsule base 2 the upper end of this engages against the wall 11 thereby achieving a seal which prevents the escape of powder towards the underlying parts. This seal is maintained for the whole of the path during which the powder can fall into the capsule base 2 so that the unwanted escape of powder from the receptacle 8 is entirely avoided, as is the consequent covering of the base 2 with powder. Consequently emission of powder into the environment which, it is repeated, can be dangerous for the workers and which is certainly damaging above all for the movable parts (bearings, cams, rotating members etc) of the machine 1 is also avoided. Further, the powder is prevented from being able to fall into the bushes 18 thereby avoiding the disadvantage which is encountered in current machines and which is manifest in a kind of gluing of the capsule base 2 into the corresponding seat formed in the bush 18, with consequences which can be easily imagined such as the stoppage of the machine for disengaging the bush 18. Finally, it is to be noted that the head 43, because of the deformable material with which it is made, absorbs the excess part of the upward thrust exerted on the capsule base 2 thereby preserving this from excessive mechanical stresses. This could be caused by dimensional differences existing between capsule bases from different manufacturing firms.

Finally, it is clear that the machine 1 described and illustrated here can have modifications and variations introduced thereto without by this departing from the protective ambit of the present invention.

In particular, any number of pins 27 and 42 and therefore of apertures 52 could be provided. Moreover the machine 1 could be made without the pins 27 which, it will be recalled, serve only the function of pressers. Finally, the upper end of the pins 42 could be formed in two pieces, for example telescopically connected, and provided with an intermediate spring adapted to absorb the excess part of the upward thrust exerted on the capsule bases 2 and preserving this from excessive mechanical stress.

CLAIMS

1. A machine for metering a predetermined quantity of powdered pharmaceutical product into a container (2), preferably a capsule base, characterised by the fact that it comprises:

a receptacle (8) rotatable about a vertical axis and into which the said powder is supplied;

at least one first aperture (52) formed in a base wall (11) of the said receptacle (8) and of smaller diameter than that of the said container (2);

a fixed body (51) installed within the said receptacle (8), with its lower face close to the upper face of the said base wall (11), to define a first path of the said first aperture (52) in which this is positioned facing a lower face of the said fixed body (51) and therefore not in contact with the said powder, and a second path in which the said aperture (52) is in direct communication with the said powder;

transport means (9) for transporting the said container (2) beneath the said receptacle (8) and along the said second defined path of the said first aperture (52); and

a lower vertical pin (42) coaxial with the said first aperture (52), carried into rotation by a first rotating body (16) rotatable about the said axis and in synchronism with the said receptacle (8), and operable to translate, by the action of second means (38, 46 and 48), alternately along

its longitudinal axis between a first position, assumed for the whole of the said second path, in which it presses the said container (2) against the lower face of the said base wall (11) coaxial with the said first aperture (52), and a second position, assumed for at least a section of the said first path, in which it is withdrawn entirely from the seat (18) formed in the said transport means (9) to house the said container (2).

2. A machine according to Claim 1, characterised by the fact that the upper end of the said lower pin (42) which in use comes into contact with the said container (2) is provided with resiliently deformable means (43) for the purpose of absorbing the excess part of the upward thrust exerted on the said container (2) whereby to preserve this from excessive mechanical stress.

3. A machine according to Claim 1 and/or Claim 2, characterised by the fact that it includes an upper vertical pin (27) coaxial with the said first pin (52), carried into rotation by the said rotating body (16), and adapted to translate, by the action of third means (24, 34, 33 and 32) alternately along its longitudinal axis to press the said powder contained in the said container (2) at least once.

4. A machine according to at least one of the preceding

Claims, characterised by the fact that the said receptacle (8) is annular.

5. A machine according to Claim 4, characterised by the fact that the said fixed body (51) has an arcuate shape with a centre at the centre of the said receptacle (8).

6. A machine according to Claim 4 and Claim 5 when dependent on Claim 3, characterised by the fact that the said fixed body (51) has a first section (53) in which there is formed, along the longitudinal axis of the said first body (51), a vertical through slot (54) and a second, solid, section (55); the said upper pin (27) being adapted, in correspondence with the said slot (54), to translate downwardly to achieve a final pressing of the said powder deposited in the container (2).

7. A machine according to any preceding Claim, characterised by the fact that the said transport means comprise a belt (9) which carries a plurality of bushes (18) within each of which is housed a respective said container (2).

8. A machine according to any of Claims from 3 to 7, characterised by the fact that it comprises:
a vertical rotating shaft (3);
the said first rotatable body (16) being of annular form

coaxial with and outside the said shaft (3) and driven to rotate thereby;

a second rotating body (5) of annular external form coaxial with the said shaft (3), driven into rotation thereby and coaxially supporting from its outside the said receptacle (8);

a plurality of said first apertures (52) uniformly distributed around an intermediate circumference of the said wall (11);

a plurality of said lower pins (42) equal in number and coaxial with the said first apertures (52);

a plurality of said upper pins (27) equal in number and coaxial with the said first apertures (52);

a first drum element (23) formed in the said first rotating body (16) and having a plurality of second apertures (44) along each of which a corresponding said lower pin (42) is adapted to slide axially;

a second drum element (21) formed in the said first rotating body (16) and having a plurality of third apertures (22) along each of which the corresponding said upper pin (27) is adapted to slide axially;

the said second means (38, 46 and 48) being adapted to cause axial reciprocating translation of the said lower pins (42); and

the said third means (34, 33 and 32) being adapted to cause determine axial reciprocating translation of the said upper pins (27).

9. A machine for metering a predetermined quantity of powdered pharmaceutical product into a container, preferably a capsule base, as described and illustrated with reference to the attached drawings:

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